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87. PROTECTING FIRST RESPONDERS TO ACTS OF TERRORISM

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INTRODUCTION

Responders to an act of terrorism will face the challenge of saving lives and property while protecting their own health and safety. Responder safety and health issues in traditional disasters, such as hazardous materials responses, are compared with those presented by biological and chemical terrorism, and challenges for worker protection are described.

Early discussions of the response to terrorism considered chemical and biological terrorism events together. This approach tends to blur the very different risks and safety challenges that these events present. It is therefore more useful to consider separately the challenges of chemical versus biological events.

CHEMICAL TERRORISM

Chemical terrorism uses toxic chemicals to harm human health, damage property, or inflict psychological distress. Chemical terrorists might use military chemical weapons, as in the 1995 use of sarin in Tokyo; however, the use of toxic industrial chemicals may be more likely. Military chemical weapons can be expensive and difficult to synthesize in large quantities, while toxic chemicals used as industrial precursors or products are widespread and easily obtained.¹ The "first responders" to an act of chemical terrorism are likely to be the usual responders to chemical incidents: firefighters, police, and designated hazardous materials (HazMat) teams.

If a terrorist act involves a deliberate release of an industrial chemical, in some regards the response is much like other HazMat events. In any toxic chemical release, responders must detect and identify the chemical agent and quantify exposure levels. The appropriate response procedures, including selection of personal protective equipment, response procedures, and decontamination can be found in existing HazMat protocols. In the US, regulations and guidelines are provided by the Occupational Safety and Health Administration, the Environmental Protection Agency, and others.^{2,3,4} These regulations suggest that when in some circumstances where the nature of the exposure hazard is not known, workers should wear totally encapsulating chemical protective suits with positive-pressure self-contained or supplied air respirators ("Level A" protection) until the hazardous exposure is identified. Responders can then step down to lower levels of protective equipment as appropriate.⁵

In some ways, however, the response to an act of chemical terrorism may differ from a conventional HazMat response. A conventional HazMat incident often occurs in an industrial park or along railroad lines or highways. These frequently are located away from densely populated areas (although chemical spills and other situations can occur in urban areas). Because there are fewer people in the affected area, there will be fewer victims to extricate and responders can limit their exposure time in the "hot zone." In addition, these events frequently occur in the open air where wind dispersion can reduce the concentration. The effectiveness of personal protective equipment and the health effects of exposure depend on the concentration of the exposure hazard and the duration of exposure, so the outdoor and remote location of an unintentional HazMat incident will help limit the responders' exposure risk.

Both concentration and time may differ in a terrorism response. An act of terrorism, carried out with intent to harm as many as possible, will likely be in a populated area. This will result in a larger number of victims requiring extrication, requiring more responder time in the hot zone. Such an act might take place in a downtown urban environment where buildings will interfere with wind dispersion or indoors in areas with limited ventilation, resulting in higher hazard concentrations. If these factors are present, the increased exposure time and concentration will contribute to the responders' exposure risk.

A terrorism response differs from a traditional HazMat event in one additional regard. A terrorist intent on harming first responders may employ a so-called "secondary device." This is typically an explosive, timed to detonate during the response to the first event and therefore to injure as many responders as possible.⁶ Responders to hazardous chemical events are frequently not ordinance disposal experts. The response to an event of chemical terrorism, therefore, may require participation from teams trained to identify and recover explosive devices.

BIOLOGICAL TERRORISM

Biological terrorism produces very different challenges, which may be quite unfamiliar to responders well versed in chemical disaster response. Responders may confront either an announced purported release of a biological agent or an outbreak resulting from successful unannounced use of a biological weapon. The appropriate response will vary depending upon the particular scenario. In all these events, the optimal response involves coordination with public health and law enforcement officials.

The most common scenario currently confronting emergency responders to date is the discovery of an envelope, package, or other container with some indication (such as a label or accompanying letter) suggesting the contents are an infectious hazard. Often the label or letter states that the contents are anthrax spores.⁷ Responders face several decisions: whether the contents truly are infectious; how to handle the package; and whether to detain, decontaminate, or administer prophylactic medications to civilians who may have been exposed to the contents.

In the US, usually law enforcement officials coordinate the collection of evidence (e.g., letters, packages, or air-handling system samples) and deliver materials to a qualified laboratory for testing. The goal is to provide test results that confirm or refute that the contents were an infection hazard. In general, public health officials, working with law enforcement and first response personnel, should determine the need for decontamination and postexposure prophylaxis. However, in most of the recent hoaxes purporting anthrax exposure, immediate postexposure decontamination and prophylaxis were not indicated because the threat was not credible. Instead, current recommendations suggest that officials collect contact information for potentially exposed persons for notification of laboratory results or other follow-up. Potentially exposed persons also should be given information about the signs and symptoms of illnesses associated with the biologic agent and about whom to contact and where to go should they develop illness.⁷

Perhaps the most likely act by a terrorist determined to use a biological weapon to cause harm will be the unannounced dissemination of an infectious agent. This assumption is supported by two instances of biological terrorism. One occurred in 1984, when members of a religious commune in Oregon intentionally contaminated salad bars to cause an outbreak of salmonellosis.⁸ The other occurred in Japan, where prior to their use of sarin, the Aum Shinrikyo cult made several unannounced and (fortunately) unsuccessful attempts to release anthrax and botulinum toxin.⁹ A successful event involving the unannounced release an of infectious agent, as occurred in Oregon, will not be recognized until the subsequent

appearance of cases of resulting illness. There will be no identified "hot zone" or emergency response to the exposure, and the "first responders" will be the providers of medical care (physicians in primary care offices and emergency departments) who first recognize and report the cases, the medical staff who care for the victims, and the public health authorities who initiate the community response to control the outbreak.¹⁰

In a bioterrorism-related disease outbreak, therefore, the response strategies for traditional first responders will differ from those of a chemical event. Responders will not control an exposure source or rescue exposed civilians. Instead, they primarily will be involved in transporting patients to medical care facilities, as they do in naturally occurring outbreaks of diseases such as influenza. Response procedures and personal protective equipment should be selected based upon principles of infection control rather than hazardous materials operations. The goal is to protect the worker from the patient's infection during care and transport. As such, recommendations for infection control in hospitals during bioterrorism outbreaks provide useful guidelines.¹¹ Personal protective equipment need not involve elaborate measures appropriate to chemical protection such as "Level A" suits. Instead, the appropriate protection entails so-called "standard precautions" to protect the worker from percutaneous or mucous membrane exposure to blood or body fluids and secretions.¹² Protective garments include impermeable gloves (latex or synthetic), gowns, and eye protection. The importance of eye protection in some diseases cannot be overstated; in the 2000 Ebola outbreak in Uganda, several fatal occupational infections among health care workers may have resulted from eye exposure from splashes or inadvertently rubbing one's eye with a contaminated finger.¹³

"Standard precautions" for diseases, which are not transmitted through the air, such as pulmonary anthrax, require only a surgical mask to prevent mucous membrane exposure when aerosols or spatter may be produced. Higher levels of respiratory protection may be needed depending upon the particular disease and how it is transmitted. Pneumococcal pneumonia may be transmitted by large droplets coughed by the patient, but these droplets are large enough that a surgical mask will protect the worker.¹⁴

Some diseases, however, are transmitted by fine aerosols; these includes smallpox, one of the potential agents of bioterrorism. Workers caring for smallpox patients will need a higher level of respiratory protection, at least that provided by a disposable respirator providing the equivalent of high-efficiency particulate filtration such as those meeting NIOSH class N95.¹⁵ It is important that users be fit tested to ensure that a given type of respirator provides an adequate seal to the user's face. Workers using respirators without fit testing frequently have so much leakage of unfiltered air that the respirator provides little or no protection - in one study, 95% of such workers had more than 33% leakage.¹⁶ Fit testing should be done as part of the organization's routine preparations - a crisis is too late to begin testing and searching for effective respirators.

However, respiratory protection is not a complete solution for some biological hazards due to the small exposure required to cause disease. The infectious dose for smallpox infection, for example, is unknown but may be as low as just a few virus particles.¹⁵ Depending upon the exposure concentration, even a respirator offering 95% reduction in exposure may not suffice, although it will reduce the exposure challenge. For this reason, responders transporting or caring for ill patients also may need immunization or antibiotic prophylaxis. Some diseases, such as pneumonic plague, warrant antibiotic postexposure prophylaxis.¹⁶ During a smallpox outbreak responders will be candidates for smallpox vaccination. However, the scarcity of the vaccine and the risk of adverse effects dictate that it be administered only to responders who, in fact, will have contact with infectious patients. Response plans should include strategies to deliver these treatments to responders, and to

provide alternatives to individual responders who are allergic to a particular drug. Antibiotics and vaccines are not needed when caring for patients with diseases not transmitted from person to person, such as botulism or anthrax.

OTHER NEEDS

Responders and health care workers also have nonspecific needs, applicable to both chemical and biological responses. One vital component of a response plan is to reach out to essential partners. In many communities first responders have little or no interaction with the local health department and thereby miss an important two-way partnership. Responders can help health department identify that an occult act has created an outbreak by monitoring the numbers of patients they transport for different types of symptoms and signs. The health department, in turn, can advise responders of what the outbreak is which are appropriate infection control precautions, and how to implement plans for providing antibiotics or immunizations to staff.

Hospital partnerships, too, should be included in responder plans for terrorism. Responders should work with hospitals to ensure plans for patient transport to facilities that will be equipped to meet the situation. During a biological event, responders must know if the community will designate a specific hospital for highly contagious diseases such as smallpox.¹⁵ Planning for a chemical event must include awareness of which hospital has adequate decontamination facilities, or whether the hospital will need the fire department's assistance with decontamination.¹⁷

Unanswered questions requiring further research remain, as well. One is the critical topic of respiratory protection. In the US, we currently lack certification standards for civilian respirators to be used against weapons of terrorism, presenting two challenges. The first is an issue of worker safety, to ensure that the respirators emergency responders use offer adequate protection against the exposures they are likely to encounter. The other is an administrative challenge: in that US regulations state that an employer can provide workers only with respirators that have been certified by the National Institute for Occupational Safety and Health, which has not previously certified respiratory protection against weapons of terrorism. Programs to develop appropriate certification standards are now being implemented.¹⁸

A second research need is to develop improved detector technology. First responders need real-time instrumentation that is rugged, portable, and can reliably identify the type and concentration of hazardous exposures, including both military and industrial chemical weapons. Again, extensive work is currently underway in this area. Finally, response agencies must recognize that responders are subjected to unique and potentially disabling stress during a disaster, so-called "critical incident stress." The knowledge base about responder critical incident stress after acts of terrorism is limited. However, experience gained from other disasters strongly indicates that response agencies must anticipate the need to protect terrorism responders from the effects of critical incident stress.¹⁹

CONCLUSION

An act of chemical or biological terrorism will require appropriate measures to protect first responders from exposure to hazardous substances or infection by biological agents. Some of the safety challenges are common to more conventional disasters such as industrial chemical spills or natural disease outbreaks, although terrorism response pose some unique challenges as well. These challenges can be met, but require advance planning to ensure that the necessary equipment, procedures, and collaborative relationships are available in the time of crisis.

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KEYWORDS

Terrorism; responders; occupational safety and health; firefighters; respirators; public health